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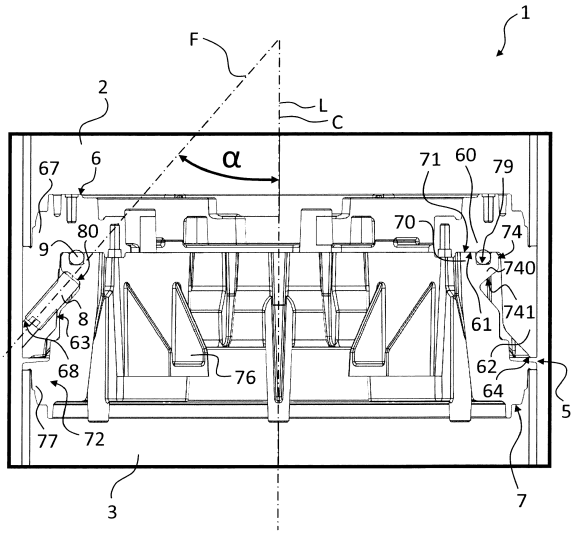
(54) MECHANICAL CONNECTION INTERFACE AND COLUMN LUMINAIRE COMPRISING A MECHANICAL CONNECTION INTERFACE

(57) The present invention is directed to a mechanical connection interface (5) for connecting columnar modules (2, 3, 4) of a column luminaire (1) along a connection axis (C), comprising an upper interface part (6) having a first abutment section (60) with a first axial abutment face (61) extending circumferentially about the connection axis (C) and a skirt section (62) axially extending from the first abutment section (60) to delimit a connection space (63) to which the first axial abutment face (61) is facing, and a lower interface part (7) having a second abutment section (70) with a second axial abutment face (71) extending circumferentially about the connection axis (C), wherein, in a connected state, the lower interface part (7) is received in the connection space (63) at least with its second axial abutment face (71) so that the first and second axial abutment faces (61, 71) are facing each other in an axial direction, and wherein the upper interface part (6) further comprises a fixing element (8) being provided to be moveable along a fixing axis (F) being obliquely oriented with respect to the connection axis (C) between a release position, in which the fixing element (8) is radially distanced from a connection section (74) of the lower interface part (7) so as to allow a relative rotational movement of the upper and lower interface parts (6, 7) about the connection axis (C), and a connection position, in which the fixing element (8) engages the connection section (74) to apply a connection between the first and second axial abutment faces (61, 71) so as to restrict or eliminate a relative rotational movement of the upper and lower interface parts (6, 7) about the connection axis (C). The present invention is further directed to a column luminaire (1) extending along a longitudinal axis (L) and comprising at least two columnar modules (2, 3, 4) being connected by the mechanical connection interface (5) according to the invention.

Fig. 4



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Description

[0001] The present invention is directed to a mechanical connection interface for connecting columnar modules of a column luminaire along a connection axis. Moreover, the present invention is directed to a column luminaire extending along a longitudinal axis - often identical to the connection axis - and comprising a plurality of columnar modules as well as the mechanical connection interface for connecting the modules along the longitudinal axis.

[0002] Column luminaires are well known in the prior art. To provide different layouts and functions and also for reasons of simplified transportation, the column luminaire can be made up of a plurality of columnar modules which need to be assembled - preferably along a longitudinal axis - to thus form the column luminaire. For connecting the columnar modules, each of the neighbouring modules along the longitudinal axis comprises an interface part via which the respective columnar modules are connected to each other. The interface parts may comprise, for instance, a flange section, which is put together and then fixed by screw connection. There is also known a corresponding flange section of the respective interface parts, which is surrounded by a separate circumferential connection ring or clamp which needs to be placed around the respective interface parts or their flange sections and then fixed by a separate fixing means, like screws.

[0003] The known column luminaires are often prone to ingress of moisture and water, which requires a complex layout and use of complex sealing elements to avoid ingress of moisture/water.

[0004] It is thus an object of the present invention to provide a mechanical connection interface for connecting columnar modules of a column luminaire as well as a column luminaire with corresponding columnar modules and respective mechanical connection interfaces for connecting these columnar modules along a longitudinal axis, which allow for an easy connection of the columnar modules and thus installation of the column luminaire while preferably providing an improved moisture/water resistance.

[0005] This object is achieved by the subject-matter defined in the independent claims. The dependent claims study further the central idea of the present invention.

[0006] According to a first aspect, the present invention is directed to a mechanical direction interface for connecting columnar modules of a column luminaire along a connection axis. The mechanical connection interface comprises an upper interface part having a first abutment section with a first axial abutment face (i.e. facing in an axial direction with respect to the connection axis) extending circumferentially about the connection axis and a skirt section axially extending from the first abutment section to delimit a connection space to which the first axial abutment phase is facing. The mechanical connection interface further comprises a lower interface part having a second abutment section with a second axial abutment face extending circumferentially about the connection axis. In a connected state, the lower interface part is received in the connection space at least with its second axial abutment face so that the first and second axial abutment faces are facing each other in an axial direction. The upper interface part further comprises a fixing element being provided to be moveable along a fixing axis being obliquely oriented with respect to the connection axis (and preferably also with respect to a plane extending in a radial direction with respect to the connection axis) between a release position, in which the fixing element is radially distanced from a connection section of the lower interface part (i.e. with respect to the connection axis) so as to allow a relative rotational movement of (i.e. between) the upper and lower interface parts (i.e. with respect to each other) about the connection axis (and preferably also to allow the upper and lower interface parts be connected to and disconnected from each other), and a connection position, in which the fixing element engages the connection section to apply a connection (e.g. frictional and/or form fit connection) between the first axial abutment face and the second axial abutment face so as to restrict or eliminate a relative rotational movement of (i.e. between) the upper and lower interface parts (i.e. with respect to each other) about the connection axis.

[0007] As the fixing element comes along with the upper interface part, installation of a luminaire with the mechanical connection interface is facilitated. This in addition with the easy movement between the release and connection position allows for an easy angular adjustment of the connected but not fixed interface parts and then an easy fixation of these interface parts in the desired relative angular position. Moreover, due to the oblique orientation of the fixing element, (frictional and/or form fit) connection between the first and second axial abutment faces can be easily obtained by simply moving the fixing element from the release position to the connection position along the fixing axis. No additional fixing means to be separately handled are required. Furthermore, vertical and horizontal forces are applied to the connection between the upper and lower interface parts thus resulting in a structural strength of the stacked columnar modules connected by the mechanical connection interface. Also, the overall layout of the mechanical connection interface can be simplified and the number of parts be reduced compared to corresponding elements of known column luminaires. Also, the oblique orientation of the fixing element allows for the same being oriented such that ingress of moisture/water is impeded. The same applies for the skirt section being put over the lower interface part and thus securely covering and hiding the abutment faces, which makes ingress of moisture/water more difficult and thus the mechanical connection interface more secure even in humid environments or outdoors. Also, the layout ensures a vertical as well as horizontal positioning of the interface parts and thus the co-

lumnar modules to be connected therewith.

[0008] As mentioned, in the connection position, the connection between the first and second axial abutment faces applied upon the fixing element engaging the connection section is a frictional connection and/or a from fit connection. The former can be simply obtained, e.g., by axial and preferably flat contact between the axial abutment faces. The latter can be obtained, e.g., by the axial abutment faces being structured, e.g., serrated or teethed. Hence, a secure and sufficient connection to restrict or eliminate the relative rotational movement of the upper and lower interface parts with respect to each other about the connection axis can be obtained in many different ways.

[0009] In the connection position, the fixing element preferably further engages the connection section by way of form fit (i.e. form fit connection) in the axial direction with respect to the connection axis. Hence, a secure fixation of the upper and lower interface parts in a way so as to avoid these parts be axially separated can be easily obtained by the fixing element in connection with the upper and lower interface parts. Hence, the layout can be facilitated and number of parts be minimized.

[0010] Between the release position and the connection position, the fixing element is preferably further provided to be moveable to an intermediate position, in which the fixing element engages the connection section by way of form fit (i.e. form fit connection) in the axial direction with respect to the connection axis while allowing relative rotational movement of (i.e. between) the upper and lower interface parts (i.e. with respect to each other) about the connection axis. With this intermediate position, a secure fixation of the upper and lower interface parts along the connection axis is obtained thus avoiding the upper and lower interface parts being axially disassembleble, while the fixing element still allows a rotational movement of the upper lower interface part relative to each other to thus allow for an angular adjustment of the upper and lower interface parts.

[0011] In the connection position and, if present, also in the intermediate position of the fixing element, the second abutment section is axially sandwiched between the fixing element and the first abutment section. This sandwiching arrangement allows for an easy and secure fixation of the upper and lower interface parts with respect to each other. The sandwiching arrangement is easily obtained by simply moving the fixing element from the release position to the intermediate/connection position. Also, the sandwiching arrangement allows for the fixing element easily applying the connection between the axial abutment faces.

[0012] The first axial abutment face and/or the second axial abutment face preferably extend circumferentially closed about the connection axis. The close circumferential extension allows for a secure and tight connection. Also, the closed circumferential extension allows for a closed circumferential connection area, which in turn may support a limitation or even elimination of an ingress of moisture/water between these connection elements. Also, the respective axial abutment faces have a rigid layout and are thus mechanically stable and allow for increased connection forces be applied.

[0013] In the connected state, the lower interface part preferably extends with a lower end section thereof being opposite to the second axial abutment face out of the connection space. Hence, the lower end section is easily accessible as preferably being exposed and can, for instance, be easily used for attachment to a corresponding column luminaire module.

[0014] The lower interface part and/or the upper interface part may comprise reinforcement ribs to increase the mechanical stability of the respective interface part. The reinforcement ribs may extend axially at or along an outer and/or preferably an inner surface of the respective interface part. The reinforcement ribs are preferably (evenly) distributed about the circumference of the respective interface part with respect to the connection axis. Hence, the reinforcement ribs can be provided in a space- and material-saving manner while still allowing for an increased mechanical stability of the respective interface parts and thus in turn of the mechanical connection interface at all.

[0015] The upper interface part, preferably the first abutment section and more preferred at a side opposite to the first axial abutment face, may comprise an upper connection portion for connecting the upper interface part to a columnar module of a column luminaire. The lower interface part, preferably the second abutment section and more preferred at a side opposite to the second axial abutment face, most preferred the lower end section, may comprise a lower connection portion for connecting the lower interface part to a columnar module of a column luminaire. Hence, the upper and/or lower interface part provide corresponding portions at advantageous locations to attach the respective interface part to a corresponding columnar module to thus obtain a column luminaire by simply mechanically connect the mechanical connection interface as defined.

[0016] The connection section may comprise an engagement section for engagement of the fixing element. The engagement section preferably extends circumferentially (closed) about the connection axis. The engagement section preferably comprises an engagement face being obliquely oriented to be substantially perpendicular with respect to the fixing axis. The provision of a defined engagement section may facilitate a secure connection between the upper and lower interface parts. In case of the engagement section extending circumferentially and preferably circumferentially closed about the connection axis allows for a connection between the upper and lower interface parts by the fixing element at desired and preferably any relative rotational angular position between these two interface parts of the mechanical connection interface. Hence, any desired relative rotational angle β can be adjusted. In case of the engagement face being obliquely oriented as described herein above, a most ac-

curate and effective engagement of the fixing element to the second abutment section can be obtained. In a preferred embodiment, the fixing element elastically and/or plastically deforms the material of the lower interface part, preferably the second abutment section and more preferred the engagement section, to thus allow - by form fit connection - for a most accurate fixation of the upper and lower interface parts with the fixing element in the connection position.

[0017] The fixing axis is preferably obliquely oriented with respect to the connection axis by an angle α of $0° < \alpha < 90°$, preferably $20° < \alpha < 70°$, more preferred $30° < \alpha < 50°$, most preferred $\alpha = 35°$ or $\alpha = 40°$ or $\alpha = 45°$. The given angle α may allow for a minimized displacement of the fixing element along the fixing axis on the one hand while still allowing for a sufficient application of an engagement force and sufficient angle α to allow for a secure and sufficiently tight abutment of the first and second axial abutment faces.

[0018] The fixing element preferably is a screw, more preferred a screw bolt (i.e. a no-head screw preferably having a cup point). The fixing element can thus be provided as a commonly known means thus resulting in a reduction of costs of the assembly compared to the more complex layouts of the prior art.

[0019] The fixing element may be arranged in a hole, preferably a threaded hole, extending in the upper interface part and preferably the skirt section along the fixing axis. Hence, the provision of the fixing element is facilitated and can be easily integrated in the upper interface part, which simplifies the overall layout of the mechanical connection interface.

[0020] The upper interface part may comprise a plurality of fixing elements, which are preferably distributed, more preferred evenly distributed, about the connection axis. For example, the number of fixing elements can be between 2 and 8, while the number of fixing elements is not limited by the present invention. Being evenly distributed over the circumference about the connection axis may allow for most accurate connection and fixation of the upper and lower interface parts with respect to each other.

[0021] The mechanical connection interface may further comprise a sealing element, like an O-ring or a gasket, being provide between the upper interface part and the lower interface part, preferably between the first abutment section and the second abutment section, more preferred between the first axial abutment face and the second axial abutment face. The sealing element preferably extends circumferentially closed about the connection axis. The provision of such a sealing element provides or increases a sealing function between the upper and lower interface parts and thus improves corresponding sealing to avoid (reduce or eliminate) ingress of moisture/water into a column luminaire via the mechanical connection interface. The sealing element can be provided in a receiving space, like a (circumferential) groove, in the respective parts, like the upper/lower interface part or its axial abutment face.

[0022] The mechanical connection interface may further comprise a stop being functionally arranged between the upper interface part and the lower interface part to restrict a relative rotational movement about the connection axis between these parts, preferably by an angle β of equal to or smaller than 360°. By provision of such a stop, a relative rotation between the upper and lower interface parts can be angularly restricted which can be useful to avoid, for instance, wiring extending between two columnar modules connected by the mechanical connection interface be twisted too far thus severely reducing the risk of electrical connections to get damaged.

[0023] According to another aspect, the present invention is further directed to a column luminaire extending along a longitudinal axis and comprising an upper columnar module, a lower columnar module as well as a mechanical connection interface according to the present invention. The upper columnar module comprises the upper interface part of the mechanical connection interface and the lower columnar module comprises the lower interface part of the mechanical connection interface to connect the upper columnar module and the lower columnar module along the longitudinal axis via the upper and lower interface parts.

[0024] Hence, the given mechanical connection interface can be used to connect corresponding modules of a column luminaire in an easy way. Therefore, the corresponding columnar modules are equipped with the upper and the lower interface parts, respectively, and can thus be easily connected by simply attaching the columnar modules by the upper and lower interface parts and then simply moving the fixing element from the release position to the connection position, e.g. by a screwing action of the fixing element. Hence, a column luminaire can be easily provided and installed while using a minimum number of parts. Also, the connection of these elements by use of the upper interface part housing the lower interface part from above, the oblique orientation of the fixing element as well as the axial abutment sections be in tight abutment results in the overall arrangement be easily and securely fixable while allowing for a secure prevention against ingress of moisture/water; e.g. by outdoor use.

[0025] The column luminaire may further comprise at least one or a plurality of intermediate columnar modules each having a further mechanical connection interface according to the present invention. Each intermediate columnar module comprises the upper and lower interface parts at opposites ends thereof to connect the upper columnar module and the lower columnar module with the intermediate columnar module or modules there between in a row along the longitudinal axis via the upper and lower interface parts, respectively. Hence, the number of columnar modules to be connected along the longitudinal axis can be varied as desired so that a column luminaire can be provided with a number (e.g. 2, 3, 4, 5, 6, etc.) of corresponding columnar modules. Hence,

any desired column luminaire with respect to number and function can be provided, thus enormously increasing the flexibility of such a column luminaire.

[0026] The mechanical connection interface can be integrated within the volume defined by the columnar modules (i.e. the outer dimensions defined by the outer contours of the modules). In other words, the columnar modules define the outer borders of the column luminaire which thus results in an increased aesthetical appearance of the column luminaire being connected with the mechanical connection interface.

[0027] The upper interface part can be separately provided to or integrally formed with the upper columnar module. The lower interface part can be separately provided to or integrally formed with the lower columnar module. The upper interface part and/or the lower interface part can be separately provided to or integrally formed with the intermediate columnar module, if present. Hence, if being separately provided, a high degree of modular layout of the column luminaire can be obtained resulting in more freedom of providing a kit of corresponding elements. On the other hand, the integrally formed layout may allow for an easier provision and less assembling steps at the location of installation of the luminaire, e.g., in case of standardized interface connections.

[0028] The upper columnar module and/or the lower columnar module and/or, if present, the intermediate columnar module may comprise a functional component, wherein the functional component comprises at least one or a plurality of the group consisting of a lighting unit for illumination, e.g. comprising a lamp like an LED-lamp or any other kind of illumination element, a loudspeaker, a camera, a sensor, etc. The type of function carried on the columnar module by the functional component is not limited by the present invention and may comprise any type and any combination of corresponding functional components usually used in the field of luminaires and in connection therewith; e.g. for control purposes.

[0029] Further features, details and advantages of the present invention will now be described by the embodiments as illustrated in the enclosed Figures.

Figure 1 shows a schematic side view of a column luminaire according to an embodiment of the present invention,

Figure 2 shows a perspective view of a detail in the region of a mechanical connection interface according to the present invention of a column luminaire according to another embodiment of the present invention,

Figure 3 shows the detail of Figure 2 in another perspective view,

Figure 4 shows a cross-sectional side view of the detail of the column luminaire of Figure 2 in the region of the mechanical connection interface in an assembled or connected state,

Figure 5 shows a perspective view of the detail of the upper interface part of the columnar module of the column luminaire of Figure 2,

Figure 6 shows a perspective view of the detail of the lower interface part of the columnar module of the column luminaire of Figure 3,

Figure 7 shows a cross sectional top view of the mechanical connection interface shown in Figure 4,

Figure 8 shows an enlarged view of detail VIII of Figure 7, and

Figure 9 shows five exemplary steps of assembly of the column luminaire of Figure 2.

[0030] The Figures show different embodiments of a column luminaire 1 or parts thereof according to the present invention. The column luminaire 1 extends along a longitudinal axis L and comprises an upper (or top) columnar module 2 and a lower (or bottom) columnar module 3, like a pole, as can be seen, for instance, in Figure 1.

[0031] The column luminaire 1 may further comprise at least one or a plurality of intermediate columnar modules 4 (e.g. three intermediate columnar modules 4 as shown as in Figure 1) being provided between and connecting the upper columnar module 2 and the lower columnar module 3 preferably in a row along the longitudinal axis L.

[0032] Moreover, the column luminaire 1 further comprises mechanical connection interfaces 5 for connecting the neighbouring columnar modules 2, 3, 4, respectively. The mechanical connection interface 5 forms an individual or separate part of the present invention and will be described in more detail in the following. While Figures 2 to 9 exemplarily show a connection between an upper and lower columnar module 2, 3, the same connection may be provided between an upper and intermediate columnar module 2, 4, two intermediate columnar modules 4, 4, as well as an intermediate and lower columnar module 4, 3, as exemplarily shown in Figure 1.

[0033] The mechanical connection interface 5 is provided for connecting the columnar modules 2, 3, 4 of the column luminaire 1 according to the present invention along a connection axis C. The connection axis C is generally in parallel to the longitudinal axis L and preferably identical or coaxial with respect to the same in a connected or assembled state of the luminaire 1.

[0034] The mechanical connection interface 5 comprises an upper interface part 6 having a first abutment section 60 with a first axial abutment face 61 extending circumferentially about the connection axis C or longitudinal axis L. The upper interface part 6 further comprises

a skirt section 62 axially extending from the first abutment section 60 to delimit a connection space 63 to(wards) which the first axial abutment face 61 is facing. In other words, as depicted, for instance, in Figures 2 and 5, the upper interface part 6 comprises a (e.g. flat) face 61 facing in or towards an axial direction with respect to the longitudinal axis L or connection axis C and also towards the connection space 63 being here laterally or radially surrounded by the skirt section 62. Here, an end portion of the skirt section 62 being opposite to the first axial abutment face 61 or first abutment section 60 circumferentially delimits a receiving opening 64.

[0035] The mechanical connection interface 5 further comprises a lower interface part 7 having a second abutment section 70 with a second axial abutment face 71 extending circumferentially about the connection axis C or longitudinal axis L.

[0036] In a connected state as, for instance, depicted in Figure 4, the lower interface part 7 is received in the connection space 63 at least with its second axial abutment face 71 so that the first axial abutment face 61 and the second axial abutment face 71 are facing (and preferably abut) each other in an axial direction, i.e. along the connection axis C or longitudinal axis L.

[0037] The upper interface part 6 further comprises a fixing element 8 being provided to be movable along a fixing axis F being obliquely oriented with respect to the connection axis C between a release position (see, for instance, Figure 9B) in which the fixing element 8 is radially distanced from a connection section 74 of the lower interface part 7 so as to allow for a relative rotational movement between the upper and lower interface parts 6, 7 about the connection axis C or longitudinal axis L, and a connection position (see, for instance, Figure 9E), in which the fixing element 8 engages the connection section 74 to apply a connection (e.g. a frictional connection and/or a form fit connection) between the first and second axial abutment faces 61, 71 so as to restrict or eliminate a relative rotational movement between the upper and lower interface parts 6, 7 about the connection axis C or longitudinal axis L. In a preferred embodiment, the connection between the first and second axial abutment faces 61, 71 applied upon the fixing element 8 engaging the connection section 74 can be a frictional connection and/or a from fit connection. Preferably, the frictional connection comes along with the form fit connection, e.g. by corresponding structures of the interface between the first and second axial abutment faces, 61, 71 to even more securely avoid a relative rotational movement of the upper and lower interface parts 6, 7 with respect to each other about the connection axis C. In this case, the first and second axial abutment faces 61, 71 may exemplarily comprise a corresponding teethed or serrated surface structure.

[0038] In the connected position as, for instance, illustrated in Figure 9E, the fixing element 8 may engage the connection section 74 by way of form fit connection in the axial direction with respect to the connection axis C or longitudinal axis L. Hence, the fixing element 8 at the same time provides a means for restricting a relative rotational movement of the upper and lower interface parts 6,7 with respect to each other about the connection axis C (or longitudinal axis L) as well as a relative tangential movement along the connection axis C (or longitudinal axis L) and thus securely fixes the upper interface part 6 and the lower interface part 7 by a comparably simple means in a secure manner.

[0039] Between the release position and the connection position, the fixing element 8 may further be provided to be movable to an intermediate position as illustrated, for instance, in Figures 9C and 9D. In the intermediate position, the fixing element 8 engages the connection section 74 by way of form fit connection in the axial direction with respect to the connection axis C (or longitudinal axis L) while allowing relative rotational movement of the upper and lower interface parts 6, 7 with respect to each other about the connection axis C (or longitudinal axis L). Hence, while the upper and lower interface parts 6, 7 are already securely connected to each other in a direction along the connection axis C to thus avoid disassembly of these two parts, a relative rotational movement between the upper and lower interface parts 6, 7 with respect to each other about the connection axis C (or longitudinal axis L) is still permitted to allow for an angular adjustment of the upper and lower interface parts 6, 7 - and thus the corresponding columnar modules 2, 3, 4 carrying the respective interface part 6, 7 - about the connection axis C or the longitudinal axis L.

[0040] As can be clearly seen in Figures 4 and 9, in the connection position and, if present, also in the intermediate position, the second abutment section 70 can be axially sandwiched between the fixing element 8 and the first abutment section 60. Hence, by a quite simple means, namely the fixing element 8 being simply moved along the fixing axis, the mechanical connection interface 5 can be easily transferred between the release position, in which the interface parts 6, 7 and thus the columnar modules 2, 3, 4 can be easily assembled and disassembled with respect to each other, and the intermediate and connection position, in which the upper interface part 6 on the one hand and the fixing element 8 on the other hand sandwiching part of the lower interface part 7, e.g. the second abutment section 70.

[0041] As can be seen, for instance, in Figures 2 and 3, the first axial abutment face 61 and/or the second axial abutment face 71 may extend circumferentially closed about the connection axis C (or the longitudinal axis L). Hence, the corresponding axial abutment faces 61, 71 provide a sufficient connection surface irrespective of an angular relative position of the upper interface part 6 with respect to the lower interface part 7. Hence, flexibility of the mechanical connection interface 5 and thus the corresponding column luminaire 1 is easily obtained.

[0042] In the connected state, the lower interface part 7 extends with a lower end section 72 thereof being opposite to the second axial abutment face 71 out of the

connection space 63. In other words, the lower end section 72 preferably extends from the second abutment section 70, e.g. as further skirt section. This may allow for an easy attachment of the lower interface part 7 to a corresponding columnar module 3, 4.

[0043] In a preferred embodiment, the upper interface part 6 as well as the lower interface part 7, preferably the first abutment section 60 and the second abutment section 70, comprise an aligned through opening 65, 75 through which, for instance, wiring of a column luminaire 1 equipped with the columnar modules 2, 3, 4 being connected by the mechanical connection interface 5 can be led through.

[0044] As can be clearly seen in Figures 2 to 7, the lower interface part 6 and/or the upper interface part 7 may comprise reinforcement ribs 66, 76 to increase the mechanical stability of the respective interface part 6, 7. The reinforcement ribs 66, 76 are here preferably evenly distributed over the circumference of the upper interface part 6 and lower interface part 7, respectively. The reinforcement ribs 66, 76 are here provided at an inner lateral surface of the respective interface part 6, 7 and preferably extend along an axial direction with respect to the connection axis C or the longitudinal axis L.

[0045] The upper interface part 6 and preferably the first abutment section 60 and more preferred at a side opposite to the first axial abutment face 61 may comprise an upper connection portion 67 for connecting the upper interface part 6 to a columnar module 2, 4 of the column luminaire 1. The lower interface part 7 and preferably the second abutment section 70 and more preferred at a side opposite to the second axial abutment face 71, most preferred the lower end section 72, may comprise a lower connection portion 77 for connecting the lower interface part 7 to a columnar module 3, 4 of the column luminaire 1. The upper and lower connection portion 67, 77 may be provided to allow for a frictional connection or a form fit connection, preferably in connection with an additional fixing means like a screw or clamp or the like.

[0046] As can be clearly seen in Figure 4, the connection section 74 may comprise a defined engagement section 740 for engagement of the fixing element 8. The engagement section 740 preferably extends circumferentially about the connection axis C; most preferably extends circumferentially closed about the connection axis C. Hence, any desired relative angular position between the upper interface part 6 and the lower interface part 7 can be adjusted by the mechanical connection interface 5. The engagement section 740 preferably comprises an engagement face 741 being obliquely oriented to be substantially perpendicular with respect to the fixing axis F. Hence, a secure and large contact area between the fixing element 8 and the corresponding connection section 74 can be easily and securely provided. In a preferred embodiment, the fixing element 8, in the connection position, may allow for an elastic or plastic deformation of the connection section 74, preferably the engagement section 740 or engagement face 741, to provide a form fit in a circumferential direction about the connection axis C of the upper and lower interface parts 6, 7. The deformation may be obtained by a tip 80 of the fixing element 8 to enter the material of the lower interface part 7. The fixing element 8, e.g. in the form of a no-head screw, therefore preferably comprises the tip 80 having a cup point geometry. The fixing element 8, however, may alternatively comprise the tip 80 having a cone point geometry, i.e. the tip 80 being tapered towards the connection section 74, which tapered tip 80 can also easily enter the material of the lower interface part 7.

[0047] As can be seen, for instance, in Figure 4, the fixing axis F may be obliquely oriented with respect to the connection axis C by an angle α of $0° < \alpha < 90°$ preferably $20° < \alpha < 70°$, more preferred $30° < \alpha > 50°$, most preferred $\alpha = 35°$ or $\alpha = 40°$ or $\alpha = 45°$. Via a corresponding angle a, the features to allow for the connection of the upper and lower interface parts 6, 7 can be provided to allow for well-balanced relation between a required action of a user to move the fixing element between the release and connection position on the one hand and an effective connection stability on the other hand.

[0048] As is exemplarily shown in Figures 4 and 9, the fixing element 8 may be a screw, preferably a screw bolt like a no-head screw. The fixing element 8 can thus be easily integrated in the body of the upper interface part 6 thus allowing for a well outer appearance of the mechanical connection interface 5. The fixing element 8 may be arranged in a hole 68, preferably a threaded hole, extending in the upper interface part 6 and preferably the skirt section 62 thereof. The upper interface part 6 may comprise a plurality of fixing elements 8 preferably being distributed and more preferred evenly distributed about the connection axis C (or the longitudinal axis L).

[0049] As can be clearly seen in Figures 3 to 5 and 9, the mechanical connection interface 5 may further comprise a sealing element 9 being provided between the upper and lower interface parts 6, 7, preferably between the first and second axial abutment faces 61, 71. The sealing element 9 may preferably extend circumferentially closed about the connection axis C (or the longitudinal axis L). The sealing element 9 can preferably be provided as an O-ring. Hence, a secure and tight sealing can be obtained. As the sealing element 9 is preferably provided between the first and second axial abutment faces 61, 71, a secure sealing can be obtained due to these axial abutment faces 61, 71 be pushed or pressed together in the connection position. As can be seen, in Figure 4, the sealing element 9 could be provided in a circumferential groove 79 of the lower interface part 7, preferably its second abutment section 70 and more preferred its second axial abutment face 71.

[0050] With reference to Figures 7 and 8, the mechanical connection interface 5 may further comprise a stop 10 being functionally arranged between the upper interface part 6 and the lower interface part 7 to restrict the relative rotational movement about the connection axis

C (or the longitudinal axis L) between these parts 6, 7. The relative rotational movement is preferably restricted by an angle β of equal to or smaller than 360°, preferably by an angle β of about 356°. The stop 10 may comprise a first stop section 11 being provided on the upper interface part 6 and a second stop section 12 being provided on the lower interface part 7 and which first and second stop sections 11, 12 radially (with respect to the connection axis C or the longitudinal axis L) overlap when seen in a circumferential direction about the connection axis C (or the longitudinal axis L) as, for instance, shown in Figures 7 and detailed in Figure 8.

[0051] As already noted, the mechanical connection interface 5 may be used in a column luminaire 1 according to the present invention. In this regard, the upper columnar module 2 here comprises the upper interface part 6 and the lower columnar module 3 comprises the lower interface part 7 to connect the upper columnar module 2 and the lower columnar module 3 to each other along the longitudinal axis L via the upper and lower interface parts 6, 7. This connection can be provided directly between these elements. It is, however, also possible that the upper and lower columnar modules 2, 3 are connected by intermediate columnar modules 4 being provided there between along the longitudinal axis L. In this case, the intermediate columnar modules 4 each have a further mechanical connection interface 5 according to the present invention. Each intermediate columnar module 5 comprises the upper and lower interface parts 6, 7 at opposite ends thereof to connect the upper columnar module 2 and the lower columnar module 3 with the intermediate columnar module or modules 4 there between in a row along the longitudinal axis L via the upper and lower interface parts 6, 7, respectively. Such a multi modular layout is exemplarily shown in Figure 1, in which the lower columnar module 3 forms a pole of the column luminaire 1, the upper columnar module 2 forms the top module thereof and the intermediate columnar modules 4 are provided there between; the so arranged and connected columnar modules 2, 3, 4 thus forming the column luminaire 1.

[0052] As can be seen, for instance, in Figure 1 in a schematic way and also in Figures 2 to 9, the mechanical connection interface 5 can be integrated within the volume defined by the columnar modules 2, 3, 4. In a preferred embodiment, the exposed outer surface, i.e. the contour, of the mechanical connection interface 5 falls in line with the exposed outer surface, i.e. the contour, of the respective columnar modules 2, 3, 4. Hence, a well aesthetical layout of the column luminaire 1 having a comparably smooth outer appearance can be provided.

[0053] The upper interface part 6 here is separately provided to the upper columnar module 2, but may also be integrally formed therewith. The lower interface part 7 here is separately provided to the lower columnar module 3, but may also be integrally formed therewith. The upper interface part 6 and/or the lower interface part 7 here are separately provided to the intermediate columnar module 4, if present, but may also be integrally formed therewith.

[0054] The upper columnar module 2 and/or the lower columnar module 3 and/or, if present, the intermediate columnar module 4 may comprise a functional component. The functional component can comprise at least one or a plurality of the group consisting of a lighting unit for illumination, a loudspeaker, a camera, a sensor, and any other functional component usually used in or for a luminaire. For instance, as exemplarily shown in Figure 1, the upper columnar module 2 comprises a lighting unit, like an LED light, for illumination purposes. The intermediate columnar modules 4 here comprise further functional components, like a loudspeaker, a display, and sensor elements. The lower columnar module 3 here forms a pole and thus the bottom part of the column luminaire 1. The lower columnar module 3 here does not comprise a functional component but is simply provided as the mechanical stand - i.e. pole - of the column luminaire 1. The lower columnar module 3 may comprise a door or cover 13 to access wiring of the column luminaire 1.

[0055] With reference to Figure 9, a method for assembly of a column luminaire 1 according to the present invention by use of the mechanical connection interface 5 is described.

[0056] As shown in Figure 9A, two or more columnar modules (i.e. an upper columnar module 2 and a lower columnar module 3 and optionally further one or a plurality of intermediate columnar modules 4) are provided. The columnar modules 2, 3, 4 are connected in a row along the longitudinal axis L by use of the mechanical connection interfaces 5 according to the present invention, respectively. At the respective connection area between two columnar modules 2, 3, 4, one of the columnar modules 2, 4 comprises the upper interface part 6 and the other of the columnar modules 3, 4 comprises the lower interface part 7. Then, the columnar modules 2, 3, 4 are connected so that the first and second axial abutment faces 61, 71 are facing each other and preferably in axial abutment. In this case, the lower interface part 7 is received in the connection space 63 at least with its second axial abutment face 71. The fixing element 8 is then facing the connection section along the fixing axis F.

[0057] As shown in Figure 9E, the fixing element 8 is moved from its release position as shown in Figures 9A and 9B to the connection position as shown in Figure 9E, e.g. by screwing action of the fixing element 8 thus moving the fixing element 8 towards the connection section 74 of the lower interface part 7 so that the fixing element 8 engages the connection section 74 to apply a connection (here, for instance, a frictional connection or also a form fit connection) between the first and second axial abutment faces 61, 71 so as to restrict or even eliminate a relative rotational movement of the upper and lower interface parts 6, 7 with respect to each other about the connection axis C. In a preferred embodiment, the fixing element 8 applies an elastic or plastic deformation of the

lower interface part 7, preferably the connection section 74, to further result in a form fit connection of the upper and lower interface parts 6, 7 about the connection axis C, thus further restricting the relative rotational movement between the upper and lower interface parts 6, 7.

[0058] In a preferred embodiment, between the release position as shown in Figure 9B and the connection position as shown in Figure 9E, the fixing element 8 may be further moved to an intermediate position, e.g. when being moved from the release position to the connection position, in which the fixing element 8 engages the connection section by way of form fit connection in the axial direction with respect to the connection axis C while still allowing relative rotational movement between the upper and lower interface parts 6, 7 about the connection axis C. This is exemplarily shown in Figure 9C. In this case, the two columnar modules 2, 3, 4 being connected here by the mechanical connection interface 5 may be angularly adjusted by relative rotation of the respective columnar modules 2, 3, 4 with respect to each other via their upper and lower interface parts 6, 7. Once being in the desired angular position about the connection axis C or longitudinal axis L, the fixing element 8 can be moved into the connection position as shown in Figure 9E thus resulting in a fixed connection between the upper and lower interface parts 6, 7 and thus the correspondingly connected columnar modules 2, 3, 4.

[0059] To avoid an overturning of the columnar modules 2, 3, 4 with respect to each other about the connection axis C or longitudinal axis L, the stop 10 may be provided to restrict the relative rotational movement of the respective columnar modules 2, 3, 4 accordingly, e.g. by an angle β of equal to or smaller than 360°.

[0060] In a preferred embodiment, the columnar modules 2, 3, 4 have a circular cross section thus resulting in the columnar modules 2, 3, 4 having a cylindrical shape, while they may also have any other cross sectional layout, e.g. a polygonal cross section like a rectangular or square cross section.

[0061] The present invention is not limited by the embodiments described herein above as long as being covered by the appended claims.

Claims

1. Mechanical connection interface (5) for connecting columnar modules (2, 3, 4) of a column luminaire (1) along a connection axis (C), comprising:

   • an upper interface part (6) having a first abutment section (60) with a first axial abutment face (61) extending circumferentially about the connection axis (C) and a skirt section (62) axially extending from the first abutment section (60) to delimit a connection space (63) to which the first axial abutment face (61) is facing,
   • a lower interface part (7) having a second abutment section (70) with a second axial abutment face (71) extending circumferentially about the connection axis (C),

   wherein, in a connected state, the lower interface part (7) is received in the connection space (63) at least with its second axial abutment face (71) so that the first and second axial abutment faces (61, 71) are facing each other in an axial direction, and
   wherein the upper interface part (6) further comprises a fixing element (8) being provided to be moveable along a fixing axis (F) being obliquely oriented with respect to the connection axis (C) between a release position, in which the fixing element (8) is radially distanced from a connection section (74) of the lower interface part (7) so as to allow a relative rotational movement of the upper and lower interface parts (6, 7) about the connection axis (C), and a connection position, in which the fixing element (8) engages the connection section (74) to apply a connection between the first and second axial abutment faces (61, 71) so as to restrict or eliminate a relative rotational movement of the upper and lower interface parts (6, 7) about the connection axis (C).

2. Mechanical connection interface (5) according to claim 1, wherein, in the connection position, the connection between the first and second axial abutment faces (61, 71) applied upon the fixing element (8) engaging the connection section (74) is a frictional connection and/or a from fit connection, and/or
   wherein, in the connection position, the fixing element (8) engages the connection section (74) by way of form fit in the axial direction with respect to the connection axis (C), and/or
   wherein, between the release position and the connection position, the fixing element (8) is further provided to be moveable to an intermediate position, in which the fixing element (8) engages the connection section (74) by way of form fit in the axial direction with respect to the connection axis (C) while allowing relative rotational movement of the upper and lower interface parts (6, 7) about the connection axis (C).

3. Mechanical connection interface (5) according to any one of the preceding claims, wherein, in the connection position and, if present, also in the intermediate position, the second abutment section (70) is axially sandwiched between the fixing element (8) and the first abutment section (60).

4. Mechanical connection interface (5) according to any one of the preceding claims, wherein the first axial abutment face (61) and/or the second axial abutment face (71) extend circumferentially closed about the connection axis (C).

5. Mechanical connection interface (5) according to

any one of the preceding claims, wherein, in the connected state, the lower interface part (7) extends with a lower end section (72) thereof being opposite to the second axial abutment face (71) out of the connection space (63), and/or
wherein the lower interface part (7) and/or the upper interface part (6) comprises reinforcement ribs (66, 67) to increase the mechanical stability of the respective interface part (6, 7).

6. Mechanical connection interface (5) according to any one of the preceding claims, wherein the upper interface part (6), preferably the first abutment section (60) and more preferred at a side opposite to the first axial abutment face (61), comprises an upper connection portion (67) for connecting the upper interface part (6) to a columnar module (2, 4) of a column luminaire (1), and/or
wherein the lower interface part (7), preferably the second abutment section (70) and more preferred at a side opposite to the second axial abutment face (71), most preferred the lower end section (72), comprises a lower connection portion (77) for connecting the lower interface part (7) to a columnar module (3, 4) of a column luminaire (1).

7. Mechanical connection interface (5) according to any one of the preceding claims, wherein the connection section (74) comprises an engagement section (740) for engagement of the fixing element (8), wherein the engagement section (740) preferably extends circumferentially about the connection axis (C), and wherein the engagement section (740) preferably comprises an engagement face (741) being obliquely oriented to be substantially perpendicular with respect to the fixing axis (F).

8. Mechanical connection interface (5) according to any one of the preceding claims, wherein the fixing axis (F) is obliquely oriented with respect to the connection axis (C) by an angle α of $0° < \alpha < 90°$, preferably $20° < \alpha < 70°$, more preferred $30° < \alpha < 50°$, most preferred $\alpha = 35°$ or $\alpha = 40°$ or $\alpha = 45°$.

9. Mechanical connection interface (5) according to any one of the preceding claims, wherein the fixing element (8) is a screw, preferably a screw bolt, and/or wherein the fixing element (8) is arranged in a hole (68), preferably a threaded hole, extending in the upper interface part (6), preferably the skirt section (62), and/or
wherein the upper interface part (6) comprises a plurality of fixing elements (8) preferably being distributed, more preferred evenly distributed about the connection axis (C).

10. Mechanical connection interface (5) according to any one of the preceding claims, further comprising a sealing element (9) being provided between the upper and lower interface parts (6, 7), preferably between the first and second axial abutment faces (61, 71), and the sealing element (9) preferably extending circumferentially closed about the connection axis (C).

11. Mechanical connection interface (5) according to any one of the preceding claims, further comprising a stop (10) being functionally arranged between the upper interface part (6) and the lower interface part (7) to restrict a relative rotational movement about the connection axis (C) between these parts (6, 7), preferably by an angle β of equal to or smaller than 360°.

12. Column luminaire (1) extending along a longitudinal axis (L) and comprising an upper columnar module (2), a lower columnar module (3) as well as a mechanical connection interface (5) according to any one of the preceding claims, wherein the upper columnar module (2) comprises the upper interface part (6) and the lower columnar module (3) comprises the lower interface part (7) to connect the upper columnar module (2) and the lower columnar module (3) along the longitudinal axis (L) via the upper and lower interface parts (6, 7).

13. Column luminaire (1) according to claim 12, further comprising at least one or a plurality of intermediate columnar modules (4) each having a further mechanical connection interface (5) according to any one of claims 1 to 11, wherein each intermediate columnar module (4) comprises the upper and lower interface parts (6, 7) at opposite ends to connect the upper columnar module (2) and the lower columnar module (3) with the intermediate columnar module(s) (4) there between in a row along the longitudinal axis (L) via the upper and lower interface parts (6, 7), respectively.

14. Column luminaire (1) according to claim 12 or 13, wherein the mechanical connection interface (5) is integrated within the volume defined by the columnar modules (2, 3, 4), and/or
wherein the upper interface part (6) is separately provided to or integrally formed with the upper columnar module (2), and/or
wherein the lower interface part (7) is separately provided to or integrally formed with the lower columnar module (3), and/or
wherein the upper interface part (6) and/or the lower interface part (7) is separately provided to or integrally formed with the intermediate columnar module (4), if present.

15. Column luminaire (1) according to any one of claims 12 to 14, wherein the upper columnar module (2)

and/or the lower columnar module (3) and/or, if present, the intermediate columnar module (4) comprises a functional component, wherein the functional component comprises at least one or a plurality of the group consisting of a lighting unit for illumination, a loudspeaker, a camera, a sensor, etc.

Fig. 1

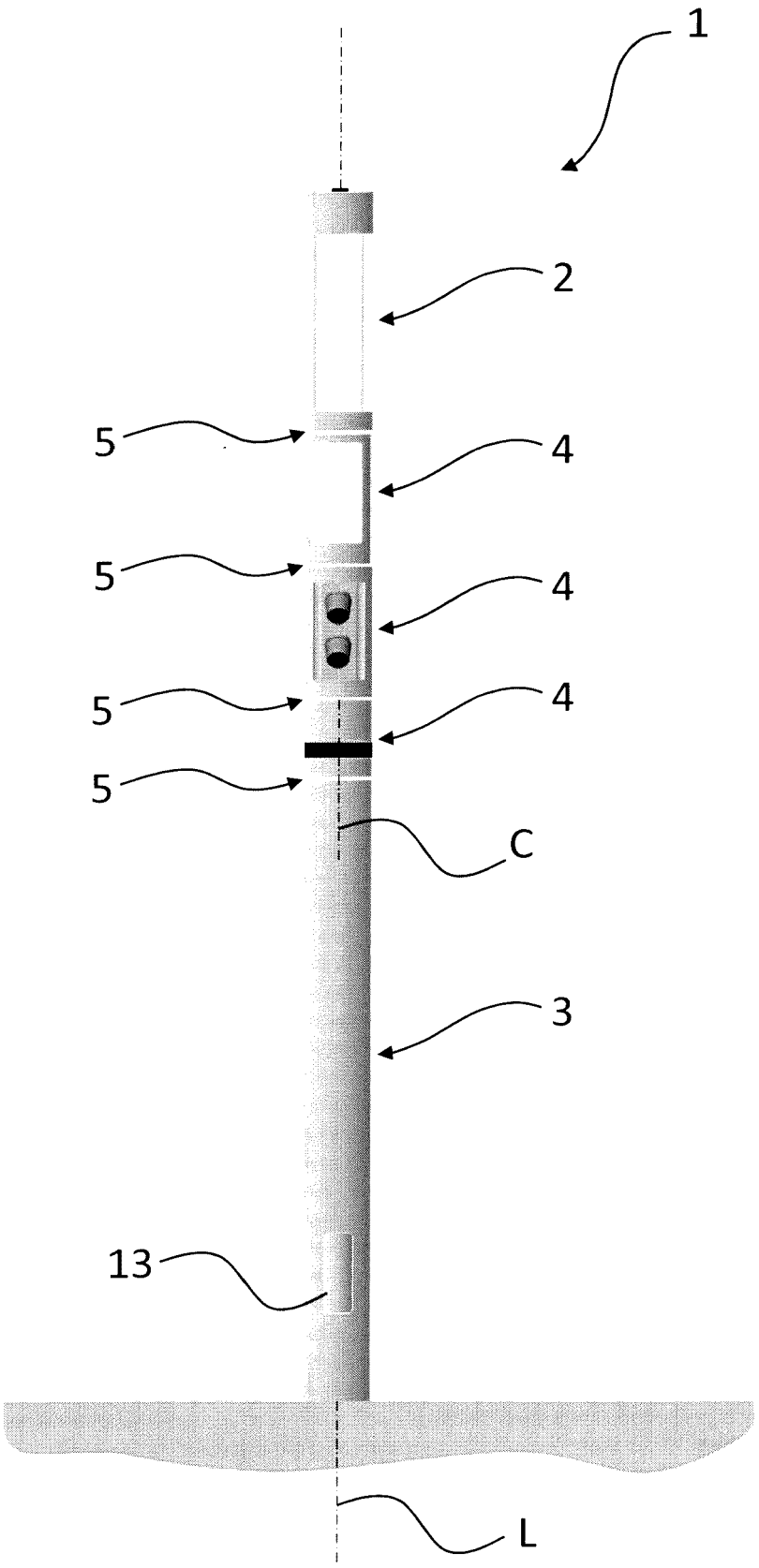

Fig. 2

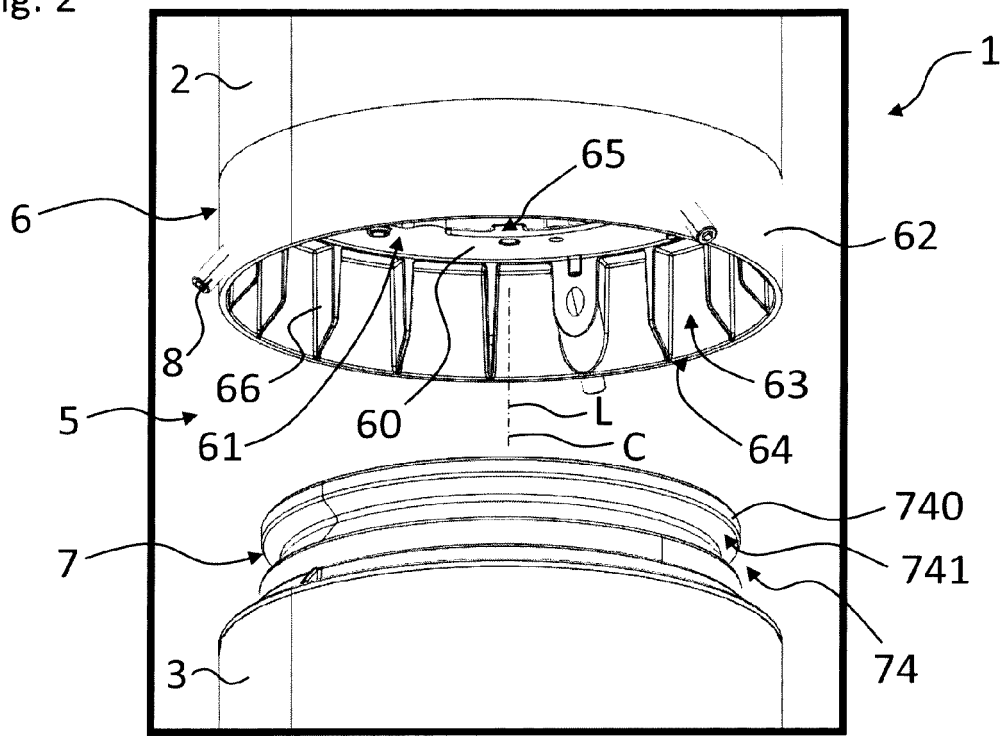
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Fig. 3

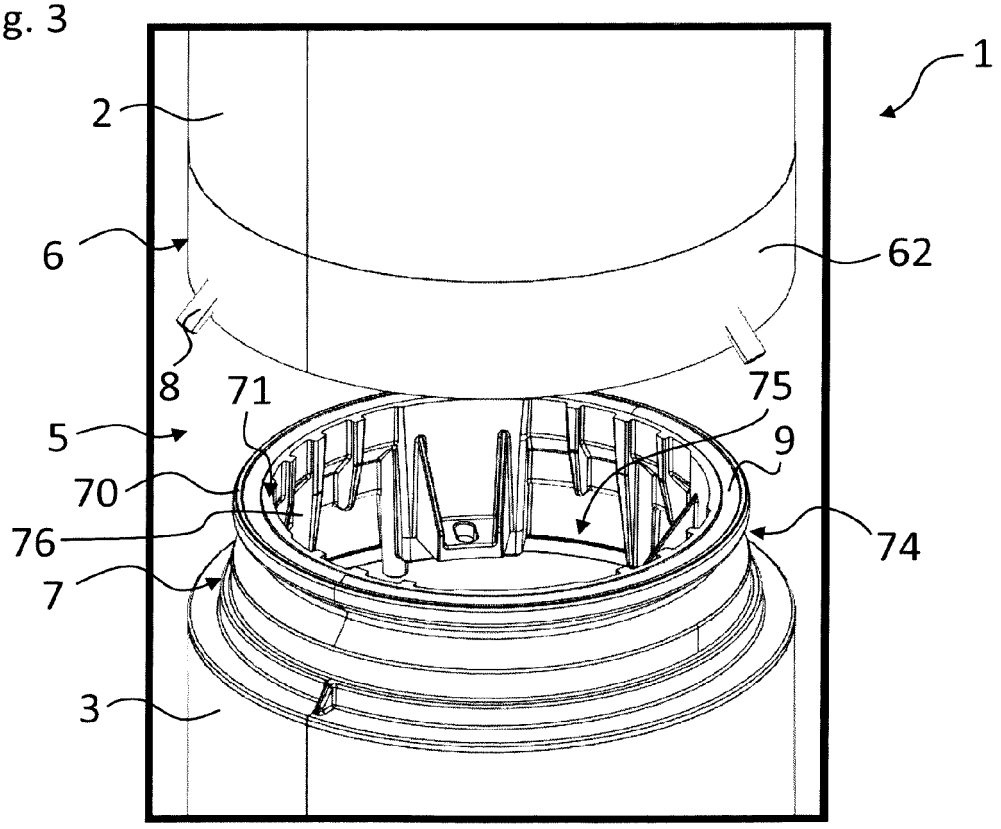
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Fig. 4

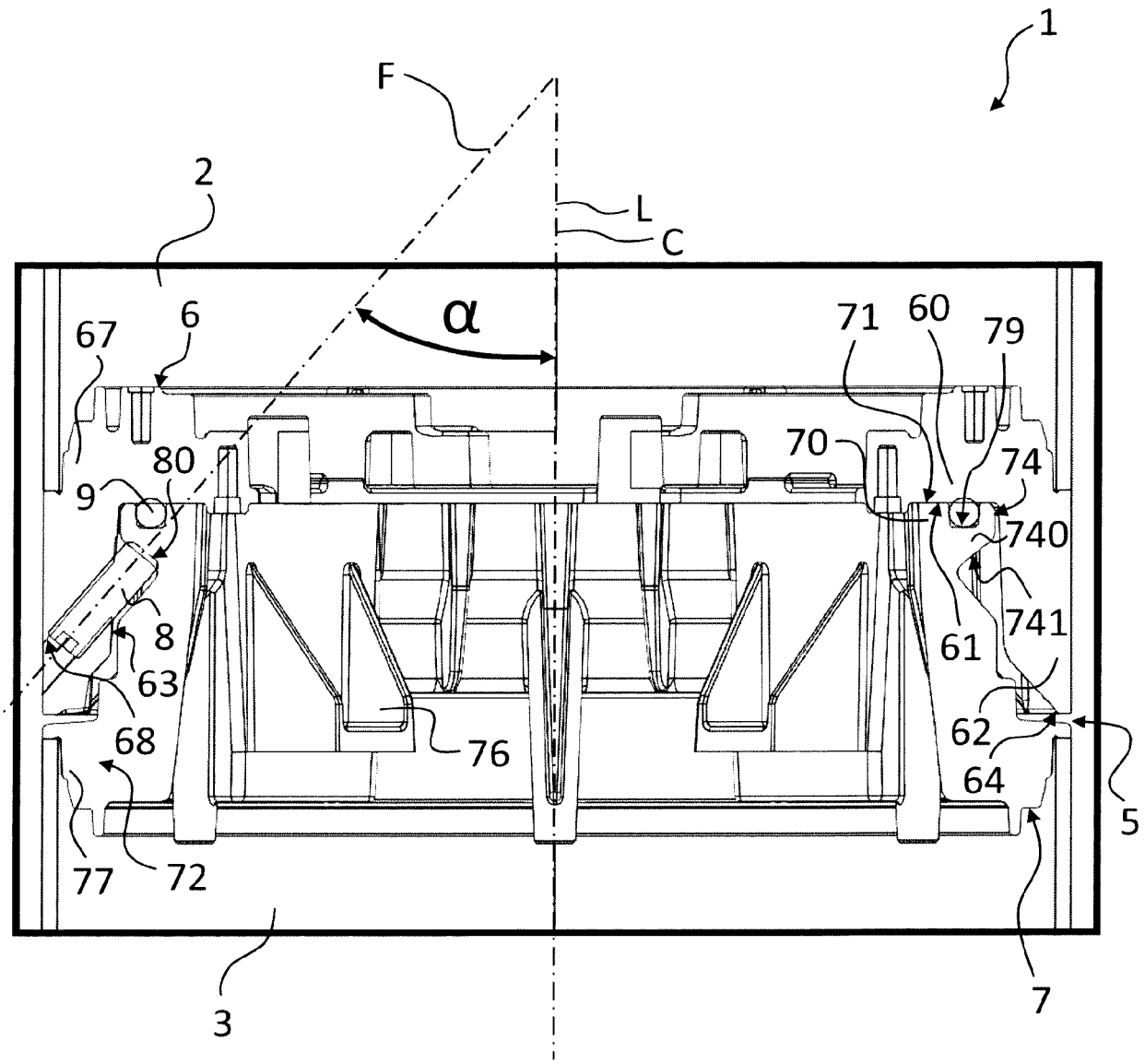


Fig. 5

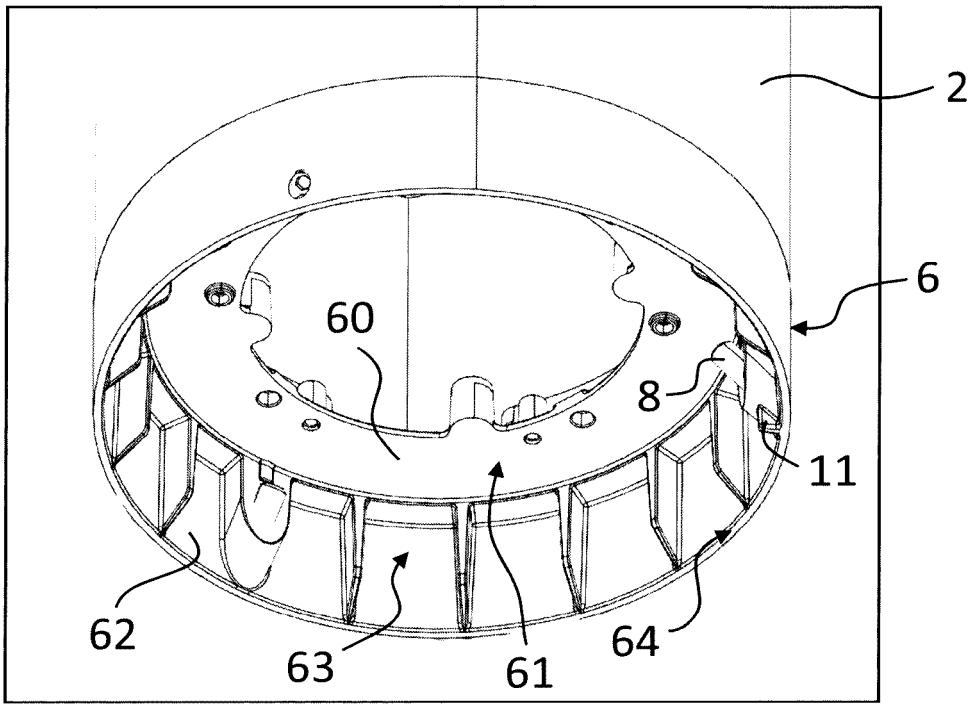


Fig. 6

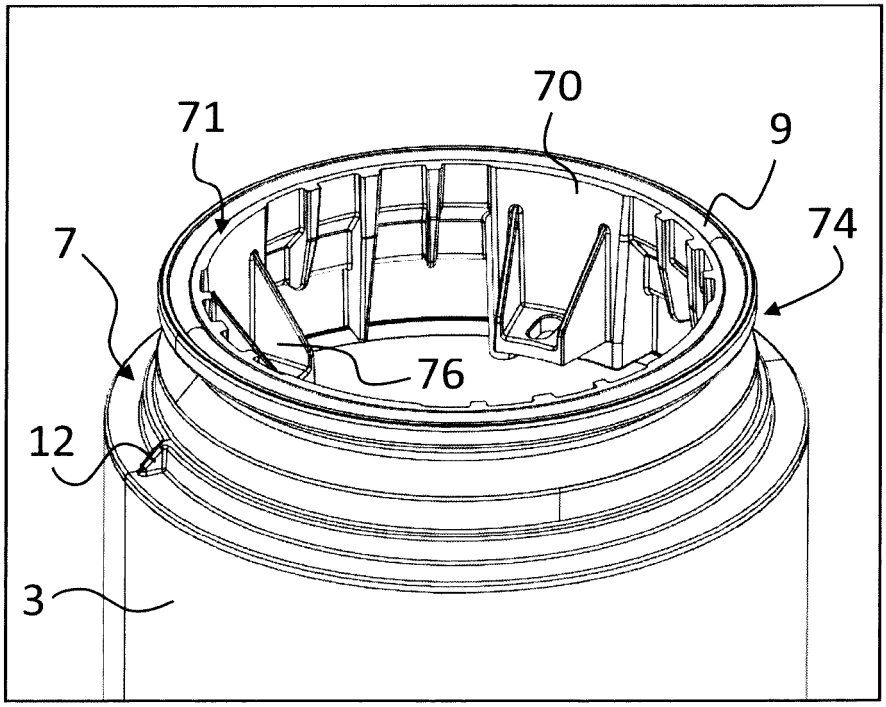


Fig. 7

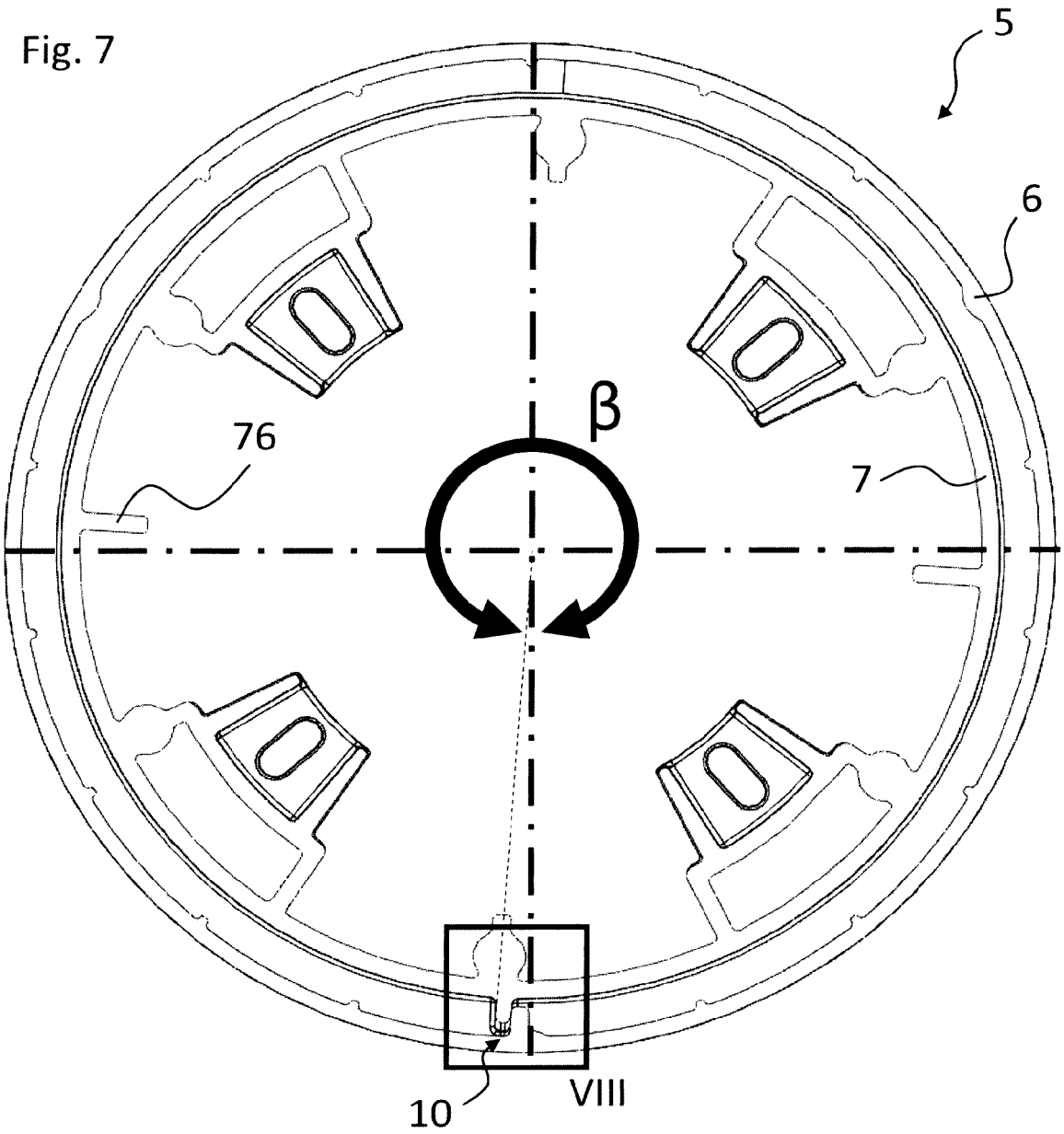


Fig. 8

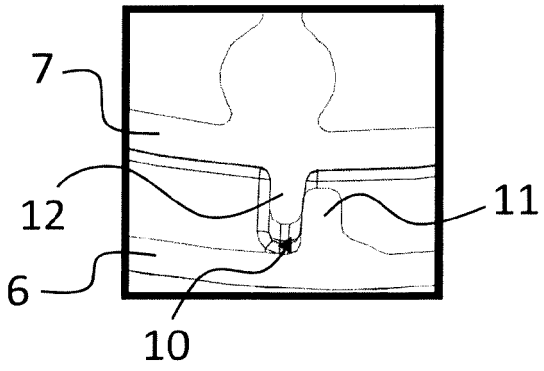
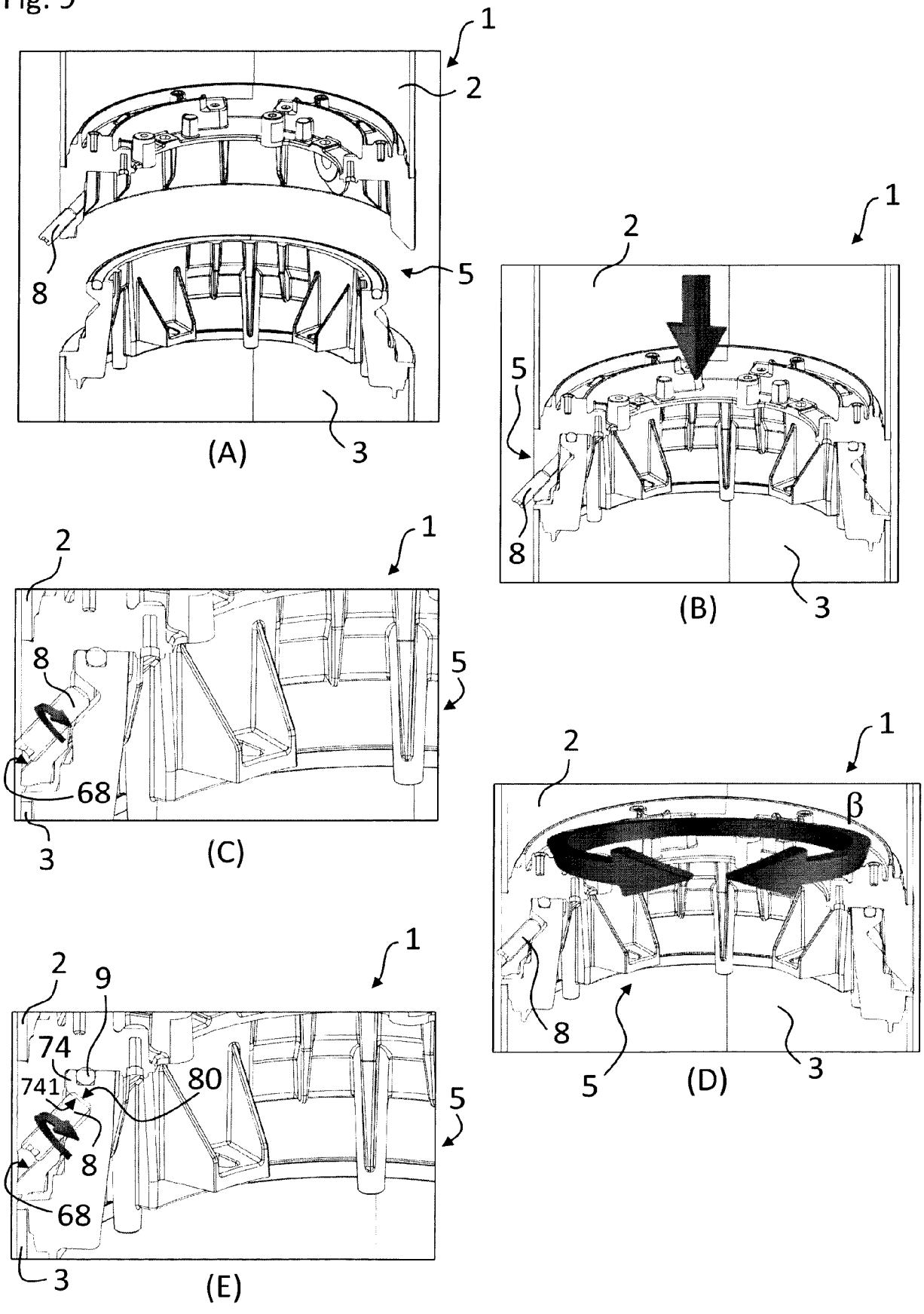


Fig. 9



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EUROPEAN SEARCH REPORT

Application Number
EP 20 29 0037

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 156 418 A (JABLONSKI EDWARD R ET AL) 10 November 1964 (1964-11-10) * figures 1-4 * -----	1-9, 11-15	INV. F21V21/10 E04H12/00 F21S8/08
X	US 4 064 432 A (COMPTON WAYNE W ET AL) 20 December 1977 (1977-12-20) * figure 1 * * column 2, line 1 - line 11 * * column 2, line 49 - line 55 * -----	1-15	ADD. F21V31/00 F21W131/103
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A	US 3 678 265 A (PORTER DAVID H ET AL) 18 July 1972 (1972-07-18) * figure 4 * -----	1	
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TECHNICAL FIELDS SEARCHED (IPC)

F21V
E04H
F21S
F21W

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 August 2020	Dinkla, Remko

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20-08-2020

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